

# Seismic Assessment and Retrofitting of Hotel Azadi in Tehran

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The Tourism and Recreational Centres Organization (TRCO) in Iran is owner of a chain of 18 international hotels in Tehran and other major cities around the country. After approximately three decades of operating the hotels, the organization has now established a master plan to renovate the hotels and build new hotels. The Parsian Azadi Grand Hotel International Hotel (Fig. 1a) is the second structural strengthening project that is being undertaken by the TRCO in the north of Tehran, a region of high seismicity.

The hotel was built in the early 1970's and is a 28-storey reinforced concrete structure consisting of RC shear walls and frames. A seismic assessment of the building was performed in August to October, 2004. The assessment was carried out based on FEMA-356, site visits, available structural drawings, concrete core tests, tests on the reinforcement steel, as well as a 3D finite element (FE) dynamic analysis of the entire building.

To summarize, neither the columns nor the shear walls at the ground level (lobby) and first floor have adequate stirrup reinforcement to resist the lateral loads imposed by a severe earthquake. It could therefore be concluded that the building can be characterised by the well-known soft storey effect and must be retrofitted, in particular, at the ground and first floor levels. To do this, the shear capacity of the columns and shear walls must be improved and the drift in these two floors must be limited to a certain amount. Furthermore, the compression capacity of the columns in the lobby and first floor must be improved.

Retrofitting design of the hotel structure included:

- the introduction of bracing at the ground and first floor (Lobby),
- the introduction of fluid viscous dampers at the ground and first floor combined with the bracing,
- strengthening (wrapping) of columns and shear walls with CFRP sheets in the ground (lobby), first floor and underground floors (Fig. 1b)

The execution of the retrofitting tasks was supervised. In-Situ and laboratory tests have been performed in order to verify the quality of the fibres, resin, the composite material and the bond between the concrete and the CFRP wraps. Damper performance and their characteristic were determined in the laboratory based on a proto type test on one of the 16 manufactured dampers.

The presentation will give an overview of the Hotel Azadi retrofitting project, the seismic assessment, a summary of execution and analysis activities, performed tests and the supervising of the execution.

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**Fig. 1.** Left: Parsian Azadi Hotel in the northern part of Tehran, Iran: main tower, south elevation, Right: Columns at the hotel lobby with a diameter of 1.5 m wrapped with CFRP